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MEMORANDUM

DATE: September 15, 2004

TO: Eric Ames, Assistant General Counsel, NMED Office of the General Counsel

CC: Sandra Ely, Bureau Chief
Debra McElroy, Compliance and Enforcement Manager
John Volkerding, Environmental Inspection Manager, Inspections Section

FROM: Robert A. Samaniego, Environmental Compliance Specialist, Inspections Section

SUBJECT: Former Intel Employee Allegations

SOURCE NAME: Intel Corporation – Rio Rancho Facility

SOURCE LOCATION: 4100 Sara Rd., Rio Rancho, Sandoval County
Township 12N, Range 2E

PERMIT NUMBER: 325-M9 **AIRS NUMBER:** 35-043-00005

I have completed my detailed review of the documents that I have received from two former Intel employees in the summer of 2003, and from Intel on December 31, 2003, on June 21, 2004 and on September 15, 2004. I will discuss each document (or group of related documents) separately. My recommendations are as follows (pertinent sections of the documents are reproduced in relevant part):

1. Draft Summary Report for Ambient Air Monitoring

This is an internal document, dated January 2003, authored by George Evans and Kelley Nelson of Intel. I originally received this document from George Evans through Fred Marsh in July 2003. I received a final version of the report from Intel on December 31, 2003. The report summarized the results of a three-month monitoring program performed by Intel's Environmental Health and Safety Department (EHS) from October – December 2002. The following sentence from the "Executive Summary" provides an overview of the rationale for the testing and the approach utilized:

"Upwind and downwind ambient analyte concentrations were evaluated at Intel's property boundaries to determine background concentrations of ambient organics and determine if upwind concentrations are statistically different than downwind concentrations."

The final two paragraphs in the “Discussion and Recommendations” section contain conclusions and recommendations that George mentioned in our telephone conversation of June 24, 2003:

“A statistical analysis using a paired t-test was performed and indicated that there was no statistical difference between upwind of Intel and downwind of Intel data. Thus, there is no data that suggests that emissions from Intel significantly contribute to the ambient organic levels within Intel’s property boundary.

It is recommended that sampling continue year-round to capture impacts due to weather variations, and to future substantiate the noted data. It is also suggested that additional sampling using modeling data for sample placement be performed. No recommendations are forwarded from the community standpoint, as the data does not suggest health effect levels from any of the noted analytes.”

George expressed to me in our telephone conversation of June 24, 2003 that Jim Casciano had removed the last paragraph above over his objections. George felt the results were of limited utility since the downwind sampling points were located at the property boundary. He felt that the sampling results would be more valid if the downwind sampling points were determined by plume-based modeling.

The decision by Intel to capture downwind samples at the property boundary as opposed to locations suggested by plume based modeling does not violate any permit condition or applicable state or federal regulation that I am aware of. In addition, this sampling program was not required by permit or regulation.

Recommendation: The information in this document does not indicate the need for any further investigation.

2. Fab 11 CUB Scrubber Plume Report (Intern Report?)

I do not know the author of this report. Someone wrote “Intern Report” and “Visible Plume” on the first page of the copy I received from George Evans through Fred Marsh in July of 2003. It is not dated. This copy apparently was not the complete report, because the pages were disjointed. I received a complete version of this report from Intel on December 31, 2003.

Of interest to the AQB is a statement on the first page (reproduced in relevant part below):

“The exhaust stack above the scrubber produces a visible white plume. A similar problem was noticed at Fab 12 in Chandler, AZ. A study by Radian International revealed the main source of the plume at Fab 12 to be aerosols of NH₄Cl (ammonium chloride) formed by the reaction of exhausted ammonia with exhausted HCl.”

The rest of the report provides some information regarding how sampling was done, and some recommendations regarding resolving the problem of plume formation.

There is no condition in the permit regarding visible emissions. Visible emissions from stationary combustion equipment are limited to 20% opacity by 20.2.61 NMAC. There are no applicable state or federal regulations regarding non-combustion related visible emissions such as those from the scrubbers. Therefore, visible emissions from the scrubbers are not in and of themselves a violation of any permit condition or applicable regulation.

On the other hand, NH₄Cl is a State Air Toxic (TAP). The screening level found in 20.2.72.502 NMAC, Table A, is 0.667 pounds per hour. The shortest stack at Intel has a correction factor of five, so in reality the applicable screening level would be five times 0.667 or 3.335 lb/hr. It is possible that emissions resulting in visible plume formation may have exceeded this screening level, although there is no evidence indicating that this was the case.

I conducted some research on a test method for NH₄Cl, speaking with the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) and several stack testers. The result of this

research is that there is no promulgated stack test method for NH_4Cl . Promulgated stack test methods have been validated under a number of different conditions so that the interferences and biases are fairly well understood, and most importantly, the results are legally binding.

Ammonium chloride is an ionic solid (salt) that will either be emitted in particulate form or dissociated in water droplets. This would eliminate FTIR analysis, which can only be used for molecules that absorb in the infrared (IR) region. Analyzing for ammonium ion (NH_4^+) and chloride ion (Cl^-) separately can be done. It would be difficult (although not impossible) to distinguish whether or not the NH_4^+ came from excess ammonia or from NH_4Cl .

In my conversations with OAQPS and the stack testers, we discussed a number of potential testing schemes to address these issues, so it might be possible to improvise a test method for NH_4Cl . Any such method would have to be validated as discussed above. In addition, after expending the required resources to improvise and validate such a method, we still would not necessarily have a promulgated test method in the end.

In the absence of a promulgated stack test method, or perhaps an agreement from Intel, it is unknown whether or not such an improvised test method (which currently does not exist) would produce legally binding results.

Intel has segregated the ammonia streams from the acid gas streams in the CUB, precluding any possible formation of NH_4Cl . A dedicated CUB ammonia scrubber was commissioned on December 19, 2003. The absence of a promulgated stack testing method for NH_4Cl is moot at this point, since NH_4Cl formation at the CUB has been eliminated.

Recommendation: There is no further action required by the Department.

3. F11 CUB Scrubber Plume Report (Authored by Jeff Kinley?)

I do not know the author of this report. Someone wrote “Jeff Kinley Author?” on the first page of the copy I received from George Evans through Fred Marsh in July of 2003. It is not dated. This copy apparently was not the complete report, because the pages were disjointed. I received a complete version of this report from Intel on December 31, 2003.

Unlike the previous report, this one does not discuss sampling. It acknowledges that there are several issues associated with the CUB scrubber:

1. Visible plume due to NH_4Cl formation, and possibly also due to water droplet formation.
2. Potential for nuisance odors (Fab 12 testing showed ammonia concentrations at the stack in excess of odor threshold values).
3. Potential exhaust air entrainment into makeup air system (possibly endangering worker safety).
4. Acknowledgement that CUB scrubber cannot adequately scrub ammonia (pH is too high).

The report included four options for addressing these issues, ranging from doing nothing, at a cost of \$0, to the preferred (and most expensive) option of installing a dedicated ammonia exhaust system and scrubber at the CUB, at a cost of \$600K.

As stated previously, visible plume formation is not in and of itself a violation of the permit, nor is it a violation of any applicable regulation. As also discussed previously, there is no evidence that the NH_4Cl screening level of 20.2.72.502 NMAC was exceeded, and the lack of a

promulgated test method complicates compliance determinations. There are no permit conditions or applicable regulations that address possible nuisance odors. The AQB has no authority regarding potential worker safety issues.

The report did indicate that Intel was aware that the CUB scrubber was inadequate with respect to scrubbing ammonia. However, inefficient scrubbing of ammonia would not in and of itself be a violation, as there are no permit conditions or applicable regulations that require a minimum scrubbing efficiency for ammonia (or any regulated pollutant that Intel uses for that matter).

However, ammonia is also a TAP. The screening level found in 20.2.72.502 NMAC, Table A, is 1.2 pounds per hour. The shortest stack at Intel has a correction factor of five, so in reality the applicable screening level would be five times 1.2 or 6.0 lb/hr. The acknowledgement that the current pH of the CUB scrubber water is too high to effectively scrub ammonia suggests the possibility that this screening level could be exceeded. The EPA does have a conditional stack testing method for ammonia (CTM-027).

The CUB scrubber was tested on September 23, 2003 for HAPs and ammonia, utilizing both CTM-027 and FTIR. The ammonia emission rate for the test period was 0.06 lb/hr by CTM-027 and 0.0056 lb/hr by FTIR, both well below the screening level.

The CUB ammonia scrubber was commissioned on December 19, 2003. Wastewater streams containing ammonia have been segregated from the other wastewater streams, and ammonia vapors have been directed to this new scrubber. This new arrangement addresses two previous problems. Ammonia is treated with a scrubber liquid with a lower pH, resulting in more efficient scrubbing. In addition, the potential formation of ammonium chloride has been eliminated, since different scrubbers now treat HCl and ammonia vapors.

The CUB ammonia scrubber was tested on March 4, 2004. The ammonia emission rate for the test period was 0.0015 lb/hr by CTM-027 and was not detected by FTIR. This is also well below the screening level.

Recommendation: There is no further action required regarding the potential exceedence of the 20.2.72.502 NMAC screening level for ammonia at the existing CUB acid gas scrubber or the new CUB ammonia scrubber

4. June 2, 2000 Odor Evacuation of Fab 11S

I have two emails dated June 3, 2000, authored by Katherine Hoopman and Frank Robinson. In addition, I have meeting minutes from an Incident Post Mortem that is not dated. It is unclear to me if I have a complete set of any of these documents. I received this group of documents from George Evans through Fred Marsh. In addition, Intel provided a document entitled "F11S 6/2/00 Odor Evacuation Update" on December 31, 2003.

Fab 11S was evacuated on June 2, 2000 from approximately 11:40 AM – 1:30 PM due to reports of chlorine odors. The documents I have do not indicate that the root cause was ever determined. There was quite a bit of speculation that the root cause was as follows; ammonia concentrations in the scrubbers were higher than normal for some unknown reason, and reacted with the residual chlorine in the scrubber water (used for biological control) to form chloramines. Winds from the east resulted in the chloramines being carried into the makeup air intakes for the fab.

I am not aware of any permit condition or applicable regulation that addresses an employee evacuation due to odors. However, the documents did indicate that some ammonia samples had

been taken, and as discussed previously ammonia is a TAP. I have no idea if they were taken in the fab or in the scrubber ducts. I also have no idea how the samples were taken.

In order to have any credible evidence that the screening level found in 20.2.72.502 NMAC, Table A was exceeded during this event, we would require ammonia concentration data obtained by a promulgated (or in this case conditional) stack test method such as CTM-027. In addition, we would also require stack gas flowrate data obtained by a promulgated stack testing method such as EPA Method 2. Since we have neither, there is no credible evidence that the screening level was exceeded during this event.

Recommendation: There is no further action required regarding the potential exceedence of the 20.2.72.502 NMAC screening level for ammonia at the Fab 11S scrubbers during the odor evacuation of June 2, 2000.

5. Project Scope of Work, PR-2-0091, CUB Ammonia Scrubber

This document appears to contain the specifications for two different options for adding a separate ammonia scrubber to the CUB. The report indicates that Jeff Kindley was the requester. I received this document from George Evans through Fred Marsh. I received a similar document from Intel on December 31, 2003.

This document is similar to the one discussed in item 3 above in that it describes the issue of the visible plume due to NH_4Cl . In addition, it provides the detailed scope for resolving this problem. It includes a number of cost estimates, etc. Someone (Fred Marsh, George Evans?) highlighted a few sentences on the “Funding Request Form” which describes items such as:

1. Scrubber stack must be modified to increase exit air velocity to prevent carryover into CUB make-up air system
2. Ammonia streams must be segregated to a separate system to eliminate plume formation.
3. Public perception due to scrubber plume.

In addition, the project justification section of the “OPS Capital Request Input Form” was also highlighted. This section expressed the items indicated in 1–3 above. I don’t know if the person(s) who highlighted these sections felt these items were potential violations of some form. Intel’s acknowledgment that the design of the original CUB exhaust system and scrubber was inadequate to prevent formation of NH_4Cl (and the attendant visible plume) is not a violation of any permit condition or regulation that I am aware of.

Recommendation: There is no further action required regarding the contents of this document.

6. Email from Chris Grotbeck dated July 1, 2003

Chris was the second former Intel employee who came forward after George Evans. He emailed me directly. His email details his allegation that Intel management did “nothing” about the CUB scrubber issue, after it was first presented by Jeff Kindley in September 2002.

He alleges that Intel management covered up the issue and chose not to implement this proposed project. He states that he questioned this decision in a subsequent meeting (date unknown), and described the response he received as “cold”. He was laid off from Intel less than a month after questioning this decision, and believes it was retaliation.

Intel has completed the installation of the CUB ammonia scrubber and it has been operational since December 19, 2003. I don’t know whether or not Intel decided to move forward on this

project due to the allegations by the former employees. In any event, the information in this email does not indicate any potential violation of any permit condition or applicable regulation.

Recommendation: The information in this document does not indicate a need for any further investigation.

7. Intel Internal Complaint Log, 9/30/93 to 8/5/00

This document contains information on complaints received in this period, as documented internally by Intel. I received this document from George Evans through Fred Marsh. I did not note any potential violations of any permit condition or applicable regulation based on the information in this document.

Recommendation: The information in this document does not indicate a need for any further investigation.

8. Telephone Conversation with George Evans, 6/24/03

George explained in quite a bit of detail his allegations regarding many of the issues already described above. His primary allegations were:

- A. Jim Casciano deleted his recommendation for plume model based sampling in his report of the Ambient Air Monitoring study conducted by Intel in October – December 2002.
- B. There were evacuations of the CUB due to the inefficiency of the CUB scrubber (no evidence provided).
- C. He believes the cooling towers are sources of chloramines.
- D. Intel did not fund the CUB scrubber project.
- E. The original stack testing company (TRC is the current stack testing consultant), Western Environmental (Western), obtained preliminary results of ethanol and methanol emission concentrations from the RTO stacks (he did not state which ones) that indicated they could exceed the annual permit limits for VOCs. He stated that when this was discussed with Western, one of their project managers stated that the test data could be made to look any way Intel wanted it to look.

I have already discussed the Ambient Air Monitoring study in item 1 (pages 1-2).

George did not provide any details regarding the alleged evacuations of the CUB scrubber. Intel did provide some documents on December 31, 2003 related to CUB evacuations between April 24 and September 9, 2000. According to Mindy Koch, these are the only documented events of CUB evacuations since January 1, 2000. There were four different events, all either sulfuric acid or sodium hydroxide spills of a few hundred gallons. The immediate areas where the spills occurred were evacuated. Intel's air permit does not regulate incidents of this type.

Regarding the allegations that the cooling towers are sources of chloramines, it is unclear as to whether or not the Department has the authority to regulate chloramines. They are not criteria pollutants, VOCs, HAPs or State Air Toxics, and could not be located on the California or Texas lists. However, potential emissions from the cooling towers should be investigated further. The EPA has recognized cooling towers as potential sources of air emissions that have routinely been overlooked by air quality agencies in the past.

Intel did provide the results of an internal analysis of potential cooling tower emissions in the documents submitted to the Department on December 31, 2003. Emissions were estimated for

both the North Energy Center (NEC) and CUB cooling towers. The details of this analysis were clarified in a document submitted on June 21, 2004. The focus of this analysis was on the constituents that are known or could be theoretically present due to the chemicals used as biocides to control biological activity in the cooling tower water. The results of this analysis were based on direct measurements of selected constituents in the cooling tower water prior to emission, and some theoretical considerations as well.

Some of the constituents that are theoretically present were not verified through direct measurement, and other regulated pollutants such as criteria pollutants, HAPs, TAPs and VOCs were not even considered in this analysis. In order to have a more comprehensive assessment of potential emission rates of regulated pollutants, the Department should request FTIR analysis of cooling tower emissions from both the CUB and NEC.

The CUB scrubber project has already been discussed in items 2 and 3 (pages 2-4).

I commenced my investigation of the allegations regarding the preliminary methanol and ethanol results by speaking with Jeffrey Knapp of Western on June 25, 2003. He was the project manager for Western when they conducted the Intel testing program in the third and fourth quarters of 2000. I explained that there were allegations that during the testing, ethanol and methanol concentrations might have been high enough to exceed the permit limit for VOCs. I also conveyed the alleged statement by the Western project manager that the test data could be made to look any way Intel wanted it to look. He did not recall the results off hand, but emphatically stated that his company would not falsify test data. He emphasized that it would be dangerous for his company to consider engaging in such an activity. I mentioned to him that ethanol and methanol concentrations in test reports by the subsequent testing contractor (TRC) decreased noticeably from the concentrations reported by Western. He did point out that quite a bit of construction was going on at the time, and that perhaps tool replacement and/or process changes were responsible for the decrease in emissions.

The documents submitted on December 31, 2003 included a portion of the HAP Test Report for the RTOs conducted on October 13–15, 2000. On page 22, Section D explains that testing was originally performed on July 12, 13 and 14, 2000 utilizing Summa Canisters. The test data was voided because the results indicated the presence of methanol and xylenes (these voided results are included as attachments to the test report). Intel stated that these compounds were not in use at that time in Fab 7 or in Fab 11 North, so the results must have been due to contamination of the Summa Canisters. I do recall discussing this situation with Intel at that time, and requested that they forward purchase documents to the Department for the period July 1999 through August 2000 inclusive, to verify that these components were not included in purchases for Fab 7 or Fab 11 North. In addition, I agreed to allow a re-test with an on-site GC so that Summa Canisters would not have to be utilized again. The results of the re-test are listed in the table below:

RTO	Fab 7 (7s.8.1)	Fab 11N (10s.8.1a)	Fab 11S (11s.8.1a)	TOTAL
Flow rate, dscfm (1)	27814	35300	28627	
Avg. Methanol Conc., ppm (1)	ND	ND	3.6	
Avg. Xylene Conc., ppm (1)	ND	ND	ND	
Methanol Mass Emission Rate, tons/yr (1)	---	---	2.5	2.5
Xylene Mass Emission Rate, tons/yr (1)	---	---	---	----

(1) Source – HAP Test Report, October 2000, Western Environmental Services and Testing, Inc.

In order to assess the potential impact on the rolling average VOC emissions for 2000, I utilized the voided data in the test report to calculate the annual potential emissions for methanol and xylene. The results are summarized in the table on the next page:

RTO	Fab 7 (7s.8.1)	Fab 11N (10s.8.1a)	Fab 11S (11s.8.1a)	TOTAL
Flow rate, dscfm (1)	27569	38262	27334	
Avg. Methanol Conc. (voided data), ppm (1)	6.3	11.3	12.3	
Avg. Xylene Conc. (voided data), ppm (1)	1.8	2.9	4.1	
Methanol Mass Emission Rate. (voided data), lb/hr	0.86	2.15	1.67	
Methanol Mass Emission Rate (voided data), tons/yr	3.78	9.42	7.33	20.5
Xylene Mass Emission Rate. (voided data), lb/hr	0.80	1.83	1.85	
Xylene Mass Emission Rate (voided data) tons/yr	3.50	8.03	8.10	19.6
Sub-Total, tons/yr				40.1
Rolling Avg. VOC Emissions Reported for 2000, tons/yr (2)				44.4
Revised total for 2000 (including voided data), tons/yr				84.5

(1) Source – HAP Test Report, October 2000, Western Environmental Services and Testing, Inc.

(2) Source – Quarterly Emissions Report, Intel Corp., Fourth Quarter 2000 (based on emission factors, excluding reported totals for methanol and xylene)

Including the voided test data increases the annual VOC emissions for 2000 from 44.4 to 84.5 tons/yr. This is still below the permit limit of 96.5 tons/yr. However, in addition to being VOCs, methanol and xylene are HAPs. The voided test result calculations for methanol and xylene indicate that the permit limit of 9.0 tons/yr for each HAP constituent would be exceeded. This would appear to be the basis for the allegation made by George Evans that the preliminary test results indicated that the permit limit for VOCs could be exceeded.

Regarding Intel’s claim that methanol and xylene were not in use in Fab 7 or Fab 11 North at the time of testing, a review of the purchase documents verify that these components were not purchased for Fab 7 for the time period in question. However, there were a handful of documents indicating the purchase of two products for Fab 11 North for the period June 7 – July 31, 2000; Megaposit 510A and Megaposit 501.

In an email dated September 15, 2004, Intel indicated that Megaposit 501 does not contain any xylene or methanol. Megaposit 510A contains 4% xylene by weight. A total of 104 gallons was purchased for Fab 11 North for this period. This is equivalent to a total of 36 pounds of xylene. The total emissions from Fab 11 North for the period June 7 – July 31, 2000 (based on a mass emission rate of 1.83 lb/hr) based on the voided data in the table above would be 2420 pounds. This would appear to substantiate Intel’s claim that the data was invalid.

There is no record of preliminary ethanol emission data indicating potential exceedence of the permit limit for VOCs. Nor do I recall ever discussing this issue with Intel at that time.

Recommendation:

- A. Request that Intel implement a testing program of cooling tower emissions utilizing FTIR analysis.
- B. No further investigation of the preliminary methanol and ethanol results is required. Analysis of all available information appears to substantiate Intel’s claim the Summa Canister results of July 12-14, 2000 were invalid.
- C. The other items above either have already been discussed or warrant no further action.

ATTACHMENTS

- 1. Documents Provided by Fred Marsh
- 2. Documents Provided by Intel